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Guidelines for general system specifications for a computer system

American Institute of Certified Public Accountants. Computer Applications Subcommittee

COMPUTER SERVICES GUIDELINES

Guidelines for General System Specifications for a Computer System

American Institute of Certified Public Accountants AICPA

Notice To Readers

Computer services guidelines are published to assist members in understanding and utilizing various aspects of data processing. These guidelines represent the recommendations of the computer services executive committee on the various topics covered.

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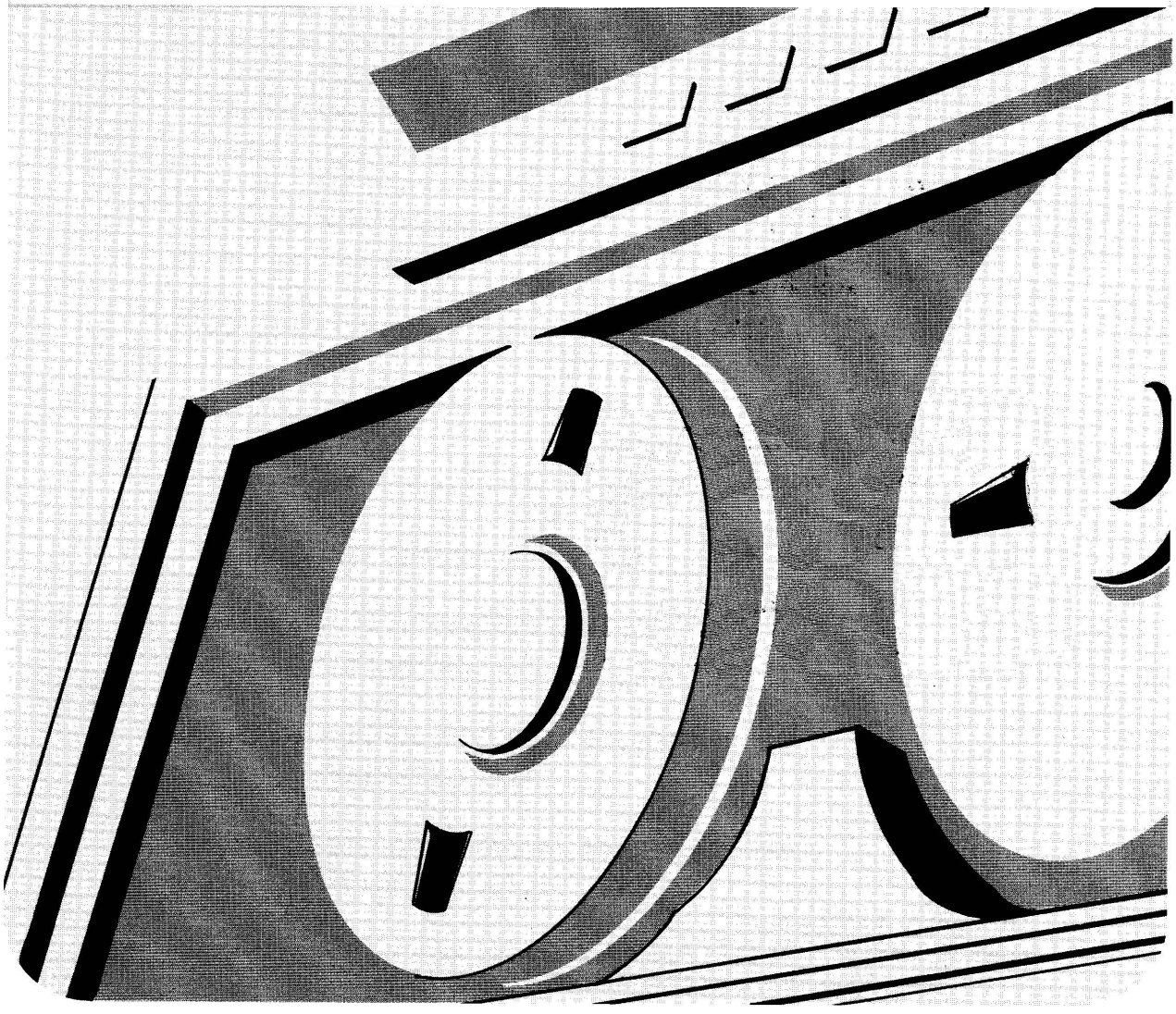

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Preface

In recent years members of the accounting profession have become increasingly aware of the benefits derived from the use of automated data processing by business enterprises and public institutions. These benefits, usually unobtainable from a manual system, have included speed in processing data, relatively high accuracy, and flexibility in processing data to produce numerous informative analyses.

The availability of such benefits motivates CPA firms to consider using automated data processing. However, the variety and complexity of means for utilizing automated data processing are such that even an experienced practitioner finds it difficult to evaluate the available options—service center, timesharing, in-house computer, and so forth. For a novice, the task is virtually impossible; therefore, it is appropriate for the AICPA to provide the profession with as much guidance as possible regarding the use of automated data processing by a CPA firm.

The computer applications subcommittee was appointed to determine the desirable features of the data processing applications for a CPA firm and an approach to selecting the equipment, software, and services for processing these applications. The first step in the work of the subcommittee has been to determine the features of the data processing applications most likely to be the components of a beginning automated data processing system for a CPA firm, including client general ledger accounting, income tax return preparation, and practice management accounting.

Introduction

There could be any number of reasons why firms become interested in the possibility of future utilization of an automated data processing system. It could be that an analysis by management has indicated that too much time is being spent on routine tasks within the firm's practice, or that meeting time deadlines for completion of work has become a problem. The firm's current and expected workload may be such that additional personnel may be needed, or the firm's public image is involved—that is, it may be important from the standpoint of client relations to be known as an organization that is conversant with computers and automated data processing.

Whatever the source of a firm's interest in automated data processing, if it is going to investigate the possibility of adopting a new system, it should be careful to structure its efforts so that no one will be bewildered by the numerous technical and economic variables involved. A firm should have a general understanding of the classes of data processing options available to it. It should also adopt an investigation and selection approach that will facilitate selecting a system to meet its needs.

Data Processing Options

The data processing options most likely to be available to firms are an in-house system or a data processing service.

In-House System. The installation of equipment on the premises to perform a firm's data processing jobs is commonly referred to as an "in-house system" option. (A variation of the in-house approach is the rental of computer time segments from other organizations having in-house computers. This is referred to as a "leased time" or "block time rental" option.) Under the in-house system option, a firm would obtain data processing equipment through either purchase or rental. A firm may also purchase or rent computer programs (software) to process its data processing applications; or it may choose to have its own personnel prepare these programs. The equipment most likely to be suitable for a firm's in-house system will be minicomputers or computers. *Minicomputers* are machines that can perform many arithmetic and logical functions associated with computer systems but are usually centered around an operator keyboard (like the familiar, key-driven accounting machine type of equipment) and have some limited capability for data entry via punched cards, punched paper tape, magnetic tape, magnetic diskette, or magnetic-striped ledger cards. Software for applications processed on these machines is typically obtained from the machine vendor. *Computers* are machines that generally have considerably greater capabilities than minicomputers, have large internal memory, perform a full range of arithmetic and logical functions, and are centered around a central processing unit with attached "peripherals" including card readers, magnetic tape drives, magnetic disk drives, paper tape readers, printers, card punches, and paper tape punches. Software for these machines is often obtained from the machine vendor but may also be obtained from independent sources or prepared by the user's own personnel.

Data Processing Service. A data processing service is a commercial organization that sells computer services. Under the data processing service option, a firm would not be involved in operating the equipment which actually performs the processing, but firm personnel may operate equipment to prepare input to be sent to the data processing service and/or to receive output from the service. The following are the

data processing services most likely to be suitable for a firm's use.

Service bureaus are companies that accept input physically transported from a firm by messenger or mail in the form of source documents or machine-readable media prepared by the firm's personnel and provide agreed-upon printed output physically transported to the firm. Software for applications processed by a service bureau is typically provided by the service bureau.[1]

Timesharing services are companies that make a central computer available for use by telephone line connection to a terminal device (such as a teletype) on a firm's premises and charge fees for use of computer time, data storage, and so forth. Software for applications processed by a timesharing service is often provided by the timesharing vendor but also may be obtained from independent sources or prepared by the user's own personnel.

Remote batch services are hybrids of the service bureau and timesharing service approaches in which a terminal device on a firm's premises would be used to prepare and transmit input for processing and to receive output.

System Selection Approach

The variety and complexity of the available data processing options and equipment can readily lead to preoccupation with equipment (or with the salesmanship of the vendor), which confuses the task of selecting a system. Therefore, a firm should be careful to use a system selection approach that emphasizes its data processing needs and keeps the data processing options in the status of tools which might be used to meet these needs.

Such an approach should generally involve the following three phases.

System Specifications. The starting point in system selection should be determining the specifications the system must meet in order to fulfill a firm's objectives in adopting an automated data processing system.

Request for Proposals. The second step should be requesting the vendors of data processing equipment and services to make formal proposals for equipment or services that meet a firm's system specifications.

Evaluation and Selection. The final step should be evaluation of vendors' proposals on the basis of the extent to which they meet the system specifications expressed in the request for proposals. This process is facilitated by applying a rating scheme that attributes evaluation point values to various specifications whereby each vendor's proposal receives a numeric evaluation score. This score can then be related to the cost of the proposed system to determine which vendor provides the greatest fulfillment of specifications per dollar of cost—an excellent criterion for system selection. An additional useful technique in evaluation and selection is to contact present users of proposed systems to obtain their reactions to the systems in actual use. For this purpose, a list of present users can be obtained from the system vendors. (Also, a list of CPA firms using various systems is on file with the AICPA and may be obtained upon request.)

[1] For a complete discussion, see American Institute of Certified Public Accountants, *Audits of Service-Centered-Produced Records* (New York: AICPA, 1974).

General System Specifications

The first step in the process of selecting a data processing system should be determining system specifications. The specifications to be met by a data processing system for use by a firm should define the characteristics needed in the system itself, its seller, and the conditions on which it is sold. These specifications can be categorized as *general specifications* and *application specifications*. General specifications define the characteristics desirable for any and all applications. Application specifications define the additional characteristics desirable for a particular application, such as general ledger accounting. This publication presents guidelines for general specifications to be used in evaluating a data processing system for use by a firm, and subsequent publications will present specifications guidelines for those applications likely to be of interest for a CPA firm that is beginning to use automated data processing.

The guidelines for general specifications presented here are derived from the following principles which are fundamental to the satisfactory use of automated data processing by a CPA firm:

1. The system should *effectively perform* the firm's data processing tasks.
2. The system should provide *reliable* data processing.
3. The system should permit data processing activity to *integrate readily* with the firm's environment, organization, and professional standards.
4. The system should be obtainable within a *proper business relationship* between its seller and the firm.
5. The system should be obtainable at a *justifiable cost*.

The guidelines for general specifications described in this publication are grouped according to the principle from which they are derived. Hence, the publication consists of these five sections—Guidelines for Performance Specifications, Guidelines for Reliability Specifications, Guidelines for Environmental Specifications, Guidelines for Contract Specifications, and Guidelines for Cost Specifications. There are also five appendixes. Appendix 1 is a presentation of the general specifications in checklist form. Appendix 2 is a set of forms for use in analyzing system costs. Appendix 3 is a summary of data processing equipment and services used by CPA firms based on a 1974 AICPA census. Appendix 4 is a reading list of selected references relating to the use of data processing by CPA firms. Appendix 5 is an explanation of the data processing terms used in this report.

Guidelines for Performance Specifications

The effectiveness of an automated data processing system in performing data processing tasks for a firm will depend on the scope, level, expandability, and usability of its processing capabilities. The scope of the system's capabilities should be broad enough to perform the data processing jobs desired. The level of its capabilities should be sufficient to handle the firm's data processing volumes at an acceptable speed. The expandability of its capabilities should be adequate to accommodate growth in the firm's practice over a reasonable period of time. The usability of its capabilities should be such that practitioners in the firm can apply them readily in serving clients or managing the practice.

Adequate Documentation

The documentation of a data processing system is extremely important for it provides the bridge between the system and the people who wish to evaluate its capabilities, operate it, and use its output. It should provide the description of the system needed to evaluate the suitability of its capabilities for the firm's needs. It should also provide all the procedural instructions necessary to permit personnel in the firm to advantageously apply its capabilities—that is, to make the system usable. The form and organization of documentation may vary among systems, but adequate documentation should include the following elements.

User Procedure Documentation. When considering a system provided by a service bureau, timesharing service, or remote batch processing service, a firm should look primarily for "user procedure documentation." User procedure documentation typically consists of a "user's manual" which presents information to help nontechnical personnel understand the system and provides detailed procedural instructions for tasks related to the system. There should be a user's manual for each data processing application including at least the following information.

Application overview is a *nontechnical* description of the application which generally explains its functions; it identifies the files it maintains and defines the content of its input and output.

Input preparation procedures are detailed procedural instructions for preparation of input source documents and conversion to machine-processable form.

Input control procedures are instructions for establishing data controls before submitting input for processing.

Input transmittal procedures are instructions for submitting the input to be processed.

Output document descriptions are examples of all output reports and other documents, accompanied by (1) a general narrative description of each output, (2) an explanation of the purpose of each output, and (3) an indication of the frequency of each output.

Output control procedures are instructions for verifying the completeness and accuracy of each output.

Error correction procedures are a listing of possible error conditions and procedures for correction and/or re-entry.

Application Technical Documentation. If a firm is considering the acquisition of an application software package or a

combination package of equipment and application software, it should expect to receive user procedure documentation as described above for each application, and it should expect to receive "application technical documentation" for each application. Application technical documentation describes and illustrates, in detailed technical terms, the functions, flow, and control of the application. The extent and complexity of application technical documentation (and its importance to a user of the data processing system) increases as the level of equipment capability increases. For example, the application technical documentation for applications to be processed on a minicomputer (such as a Burroughs Series L machine, an IBM System/32, or an NCR 399) is generally very brief because users of this level of equipment do not modify the software and, therefore, do not need to know its technical details. On the other hand, the application software for larger computers (such as a Burroughs B1700, an IBM System/3, or an NCR Century) should be more detailed because the user's programmers will need technical information in order to make modifications.

The form and organization of application technical documentation may vary among systems. However, for applications which are to be processed on equipment of the B1700, System/3, Century level, or larger, it should contain the following elements.

Application overview is a description of the application's functions, the files it maintains, its input, and its output.

System flowchart is a graphic representation of the relationship between the files, input, programs, and output.

System flow narrative is a narrative description of each process illustrated by the system flowchart which elaborates upon what the flowchart shows.

File description is a detailed description of the purpose, contents, and organization of each file used in the system.

Input description is a description of each input item in the form in which it enters the system.

Output description is a description of each output of the system.

Processing description is a description of the general operation of each program in the system.

Equipment Operations Documentation. Whether using a system processed by an in-house computer or a system provided by a service bureau, timesharing service, or remote batch service, there should be "equipment operations documentation" relating to any equipment which will be operated by the firm's personnel. This documentation will vary according to whether the equipment involved is as simple as a keypunch or typewriter terminal or as complex as a computer. In any case, the equipment operations documentation should provide complete instructions for setting up the equipment for various jobs, running the equipment under normal running conditions, and any special action required if trouble develops.

Adequate Processing Throughput

The "throughput capability" of a system is the rate of speed at which it can receive input, perform processing, and produce finished output. Clearly, a system's throughput capability will be a major determinant of its usefulness to a firm because the jobs the system can do will have an economic value only if they are performed within the time schedule considered necessary.

If a firm is considering a system that will be provided by a service bureau, timesharing service, or remote batch service, determining the adequacy of the system's throughput capability is simple. In these system approaches the throughput capability is measured by the time that will elapse between sending input to the service center and receiving finished output from the service center. All that is needed to evaluate the adequacy of the system's throughput capability is to tell the service vendor the expected processing volumes and ask him what commitment he will make regarding the time between input and output. If the

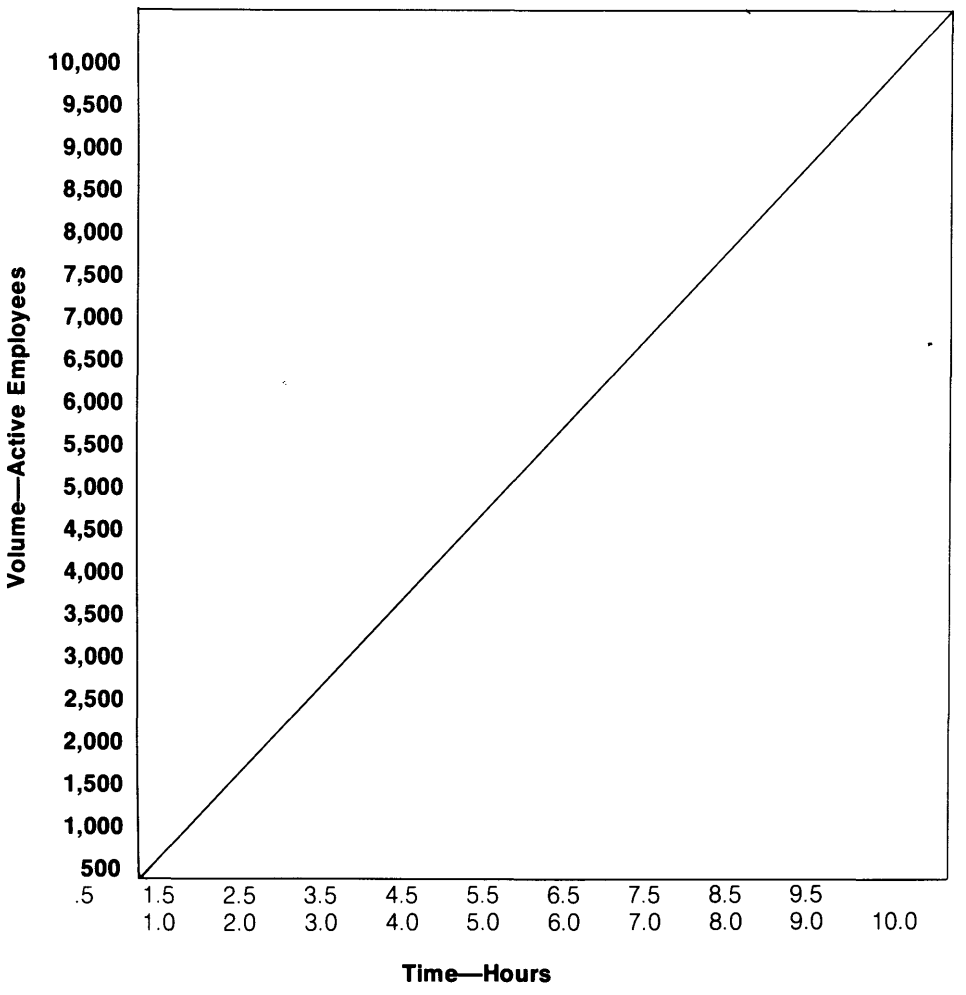
commitment satisfies the firm's schedule requirements, then it can consider the system to offer adequate throughput capability.

Evaluating the adequacy of throughput capability of a system to be processed by an in-house computer takes a bit more effort. Equipment and software vendors generally have information on the timing for processing applications derived from tests performed for their own purposes. This information should be available in terms of a ratio of processing volume to processing time—for example, the number of accounts updated per hour by a general ledger application package. In many applications the ratio of volume to time varies as volume increases, so a series of ratios covering the minimum-to-maximum volume range should be stated, preferably by means of a graphic presentation. (An example of the type of timing information available from an equipment vendor is shown below.)

Having obtained the timing information for each application from the vendor, firms should apply the timing to expected volume in order to calculate how much computer time it will take to process work on a daily, weekly, and monthly basis. These time estimates should then be worked into an overall schedule to determine whether or not the result will meet the firm's requirements. If it will, the firm can consider the system to offer adequate throughput capability.

APPLICATION TIMING CHART EXAMPLE

Payroll Application—Timing Chart*



*Timings are actual stopwatch timings but do not include set-up time.

Adequate Data Storage

The data storage provided by a system determines its workload handling capability in terms of capacity in the same fashion that throughput rate determines its workload handling capability in terms of speed. Whereas the throughput rate determines *how long* it takes to update the accounts in a client's general ledger, the data storage capacity determines *how many* accounts the general ledger can contain and *how many* clients' general ledgers can be maintained.

The data storage capacity of a system may be limited by equipment characteristics, software characteristics, or both. If a firm buys or leases a computer to be operated on its premises and acquires software to process applications, the data storage capacity of the system and the cost will be fixed. If a firm uses a service, the data storage capacity of the service vendor's equipment and/or software is likely to be so large that it is virtually unlimited. However, a service will probably charge a fee based on the amount of storage capacity consumed; thus, there will be a storage capacity limit *at a given level of cost.*

Firms should evaluate a system's data storage capacity by asking the vendor to state the capacity limits for each application in terms of application volume units. For example, in the case of a general ledger application, the maximum number of general ledger accounts would probably be one of the capacity limits. When a firm has obtained the vendor's statement of capacity limits, it should then compare its expected volume to the limits in order to determine the adequacy of the system's data storage capacity.

Workload Expansion Capability

In order to provide effective data processing performance, a system should offer capabilities adequate to meet a firm's present requirements and permit expansion as the volume of work increases or the scope of processing requirements broadens. The question of expansion capability may seem to apply only to a firm installing a computer on its premises. However, the applications proposed by a service are generally designed to operate within a range of volumes and to provide a specific scope of processing features. A terminal or other equipment installed at a firm's offices in conjunction with the use of a data processing service will have limits. Hence, the capability for workload expansion should be a consideration in planning to either install an in-house computer or utilize a service.

Some specific characteristics a system should possess in order to provide adequate workload expansion capability are these:

Flexibility. The system should be sufficiently flexible in terms of the equipment and software changes that can be easily made to respond to reasonably foreseeable changes in processing volumes, schedule requirements, input types and formats, output types and formats, or processing functions.

Compatibility. The characteristics of the equipment and software used in the system should be sufficiently similar to higher-level equipment or software available from the computer vendor or data processing services so that an upgrade could be made readily.

Peripheral equipment options. If the system involves the installation of a computer or equipment relating to the use of a data processing service (for example, a terminal device) in the firm's offices, it should be possible to increase the system's workload capacity by exchanging or adding peripheral equipment to provide faster throughput or increased data storage capacity. For example, if the equipment is a computer, the printer might be exchanged for a faster printer; or, if the equipment is a timesharing terminal, an attached paper

tape reader/punch might be exchanged for a magnetic tape cassette or diskette device.

Software expandability. If the programs used in the system impose any limits on the volume of application units processed (for example, maximum number of journal entries that can be submitted in a given general ledger updating cycle), it should be possible to easily modify these programs to increase the limits.

The system should not impose unacceptable programming language or operating software restrictions. If considering the use of a minicomputer or a data processing service that will never involve any writing or modifying of computer programs by its own personnel, a firm will not have to be concerned about the programming language or operating software the system uses. However, if a firm is considering a computer or a service which may involve programming by its own personnel, it should be cautious about acquiring a system which employs a programming language that is not widely used. The programs in such a system may be difficult to modify or expand, and it may be difficult to either train the firm's personnel or hire experienced personnel to do the work.

Larger computers, timesharing services, and remote batch processing services generally involve the use of "operating software." Operating software provides control and utility functions that facilitate processing by organizing program execution, performing sorts, compiling programs, and so forth. A firm should always be sure that the computer or service operation will not constrain any ability to modify application programs or unduly restrict the way in which application programs are used.

Guidelines for Reliability Specifications

A data processing system's reliability in performing a firm's data processing task depends on its ability to minimize errors, check the accuracy of data, prevent unauthorized or fraudulent manipulation of data, and assure continuous operation in accordance with the firm's data processing schedule. The following specifications describe characteristics which are important to the reliability of a data processing system.

Adequate Data Controls

The ability of a system to minimize errors and check the accuracy of data is a function of the data controls it provides. Therefore, when a firm considers either the acquisition of an application for processing on its own computer or the use of an application provided by a data processing service, the firm should carefully examine the documentation of the application to determine if it provides adequate data controls. A firm should expect the system to provide the following data controls.

Internal system checks. The system should provide internal equipment and/or software functions to detect

1. Input errors caused by improper input preparation, improper conversion of data to machine-readable form, loss of input records, input reading malfunctions, or data transmission malfunctions.

2. Processing errors caused by equipment malfunctions, operator error, or incorrect input data.

Audit trail. The system should incorporate features which facilitate the tracing of processing steps in order to permit the analysis of detail underlying final output, including

1. A clear designation on each output report as to the individual or business entity to which it relates.

2. A clear identification of the information on each output report by either computer-printed or pre-printed column headings.

3. An indication of the as-of-date and/or the processing date on all output reports.

4. A clear designation of all amount fields which have a negative value.

5. Accounting for every transaction entering the system.

6. Availability for examination, in either hard-copy or visual display form, of every transaction entered and the records affected thereby (in accordance with applicable retention period rules).

Adequate Security

Security involves protecting the reliability of the system by protecting both the data processing facility and the data itself. If a firm installs a computer in its offices, the responsibility for security will rest entirely with the firm. In the case of a minicomputer, it is likely that the normal security measures now employed to protect the firm's records

and information relating to clients will be adequate to protect the data processing system. If a larger computer is installed more elaborate security measures may be advisable.

If a firm utilizes a service bureau, remote batch processing service, or timesharing service, the responsibility for security will rest almost entirely with the outside organization. Hence, in evaluating such services, a firm should consider the security measures employed in the following areas.

Physical security. Measures that protect the data processing facilities include

1. Protection against unauthorized entry by means such as a location which has limited access, guarded entrances, and restricted entry requiring the use of keys or badge by authorized personnel.
2. Protection against fire by means such as fire-resistant structure, proper housekeeping to maintain a noncombustible environment, sufficient availability of fire extinguishers, fire and smoke detectors, automatic fire extinguishing systems, emergency power shut-off switches, protective enclosures for data processing media (tapes, disks, and so forth), and storage of paper products and other combustible supplies in an area separate from data processing equipment.
3. Protection against water damage through an above ground location, drains and pumps if the location is below ground, and emergency shut-off valves for building water supplies and air conditioning water.
4. Protection against damage from external events (storms, riots, and so forth) by housing equipment in buildings with no external windows, or, if buildings have windows, the availability of closable window coverings.
5. Protection against electrical power supply loss through use of an uninterruptible power source, backup power from another source, a standby motor-generator facility, and a variable supply transformer for adjusting to changes in power supply voltage.
6. Protection against unanticipated or unpreventable hazards by prior arrangements to use a backup computer installation far enough away from the primary facility so that it is not subject to the same hazards.

Data security. Measures which could be instituted to protect data from improper disclosure or modification and from damage or loss. They could include

1. Protection against loss or destruction of data by frequent review (preferably within the system itself) of applicable material for completeness, and off-site storage of duplicates or backups for all applicable materials.
2. Protection against unauthorized access to, or modification of, data by means such as coding or scrambling of data, and (in the case of remote batch or timesharing systems) automatic identification and control of terminals and users through user numbers, passwords, and so forth.

Adequate "Uptime"

The reliability of a data processing system, in terms of its ability to assure continuous operation in accordance with the firm's data processing schedule, depends upon the system's being in a fully operational state when needed. The time during which a system is fully operational and available for processing is referred to as "uptime." The uptime of a system is the total possible time the system could be available reduced by "downtime," which consists of time the system is not available because of scheduled stoppages for preventive maintenance or other purposes and unscheduled stoppages for correction of equipment or software malfunctions.

Firms can determine the adequacy of uptime for a system offered by a data processing service fairly easily. Data processing service organizations usually

keep records of the downtime they have experienced; hence, firms can obtain this information from the service organization and apply it to any throughput capability information obtained to determine whether or not the system uptime will be adequate for a data processing schedule.

A firm will have to perform some calculations to determine the uptime that should be available from a computer installed in its offices. The firm should work back to uptime by calculating downtime—the total time lost to scheduled and unscheduled stoppages. Time for scheduled stoppages can be determined from the equipment vendor's preventive maintenance schedule. Time for unscheduled stoppages can be determined by applying estimates of the frequency and average length of these occurrences. Frequency of occurrence can be estimated as the mean time between failures (MTBF), which should be part of the manufacturer's specifications for the system. The length of each occurrence can be estimated as the mean time to repair (MTTR), which should be a service commitment the vendor makes to the firm. When the firm has calculated estimated downtime and then uptime, it should apply this estimate to the throughput capability information obtained previously to determine whether the system uptime will be adequate for the firm's data processing schedule.

Adequate Support by Vendor

The foregoing discussion illustrates that the reliability of a system depends upon uptime, which (if the system involves installation of a computer in a firm's offices) depends, in turn, partly upon the service commitment the equipment vendor will make for repairing unexpected equipment malfunctions (mean time to repair). This service commitment is the equipment maintenance "support" the vendor will provide for the system.

Other types of support should be provided by the vendor of a system—whether the system involves the installation of a computer, acquisition of a software package, or use of a data processing service—to assure the system's reliability. Such support should include the following aspects.

Continuity. The vendor should be able to demonstrate that its financial condition is sufficient to assure its continued operation and ability to support the system.

Training. The vendor should make available, either as part of the system price or for an additional fee, any specialized training needed for a firm's personnel to effectively operate and use the system.

Conversion assistance. The vendor should make available, either as part of the system price or for an additional fee, technical assistance that a firm may need in converting to the system.

Updating. The vendor should make available, either as part of the system price, or for an additional fee, assistance a firm may need in connection with technical updating of the equipment and/or software comprising the system.

Guidelines for Environmental Specifications

A data processing system will be a useful and productive resource for a firm only if it can be effectively integrated with the firm's working environment, organization, and professional standards. A system's ability to become part of the firm's environment depends upon the ease with which it can be physically installed, the extent to which it will require the addition of specialized personnel or changes in the functions of present personnel, and the amount of effort required to use it on a continuing basis within the firm's operations. Firms should consider the following specifications in relating to a system's ability to be integrated with its environment.

Physical Facility Requirements

The use of a data processing system involving the installation of any equipment on a firm's premises will impose some physical facility requirements. These will vary among systems, and their effects will vary among CPA firms. A firm should evaluate the requirements of the specific system it is considering in relation to the effort and cost which would be needed to meet them. (Comparing the costs and benefits of a system is discussed in detail in the "Guidelines for Cost Specifications" section.)

Hence, a firm should obtain from the system vendor a precise statement of the physical facility requirements for any system involving the installation of equipment on the firm's premises. It should then determine whether or not these requirements would be acceptable in comparison with the benefits to be derived. Particularly, a firm should consider the following factors in its evaluations.

Floor space. Space must be available to permit installation of equipment in a layout that will allow efficient operation and maintenance, and any additional space that must be available for personnel, storage of repair parts, supplies, and file storage media.

Floor loading. Load-bearing capacity is needed for floors to provide safe and stable support for the equipment.

Raised flooring. A platform may be needed for the installation of cables under equipment units.

Electrical supply. Special electrical facilities may be required to provide power to the equipment at the proper voltages and with proper avoidance of interference from other electrical devices.

Air conditioning. Temperature and humidity control is required for proper functioning of equipment and storage of data processing media.

Noise reduction. Provisions which may be necessary to avoid the disturbance of work areas by noise produced by the equipment.

Communications. Special telephone lines and equipment may be necessary for systems involving data transmission.

Personnel Requirements

The use of any type of data processing system by a firm will require a commitment by the firm to assign to operating the system personnel having qualifications and time commensurate with the tasks to be performed. Experience in industry has clearly shown that personnel factors have a major effect on the operation of data processing systems—the best of systems have failed when proper personnel were lacking, but mediocre systems have produced satisfactory results when operated by highly skilled people.

A firm should recognize any changes in functions of present personnel or the addition of personnel which the system would require, and it should determine whether or not these requirements would be acceptable in terms of their effect on the firm's working environment.

Specifically, firms should consider the following matters.

Qualifications. The data processing education, experience, and aptitudes required for personnel who will work with the system (firms should be able to get some guidance on this from the system vendor and present users of the system).

Availability. The availability of personnel who are within the firm, or who could be employed, having the necessary qualifications.

Number. The number of personnel who would be reassigned within the firm and/or added to the firm's staff to operate the system and the resulting organizational and economic impact.

Guidelines for Contract Specifications

A firm's data processing system should be obtainable within the context of a proper business relationship with the parties providing products or services. The formulation of a formal contractual agreement between the firm and the vendor of the data processing products or services is essential to such a relationship. At the very least, a contract can improve the chances of acquiring a data processing system that performs as desired and reduces the chances of delays in delivery, unforeseen expense, disappointing performance, and arguments as to compliance with commitments.

A firm should consult with its legal counsel in formulating agreements with vendors, and it should make certain that the agreements contain provisions which, as applicable, cover the following aspects of the relationship between vendor and user.

Specifications and costs. Precise descriptions must be provided for each item of goods or services and the cost thereof.

Term of agreement. The normal duration of the contract and any provisions for early cancellation must be stated.

Contractor commitments, warranties, and representations. Included must be a precise statement of the responsibility the seller assumes for

1. Prices and options it is committed to.
2. Warranties or representations made about hardware or software performance.
3. Representations regarding training to be provided, services to be performed, or prices to remain in force over a fixed period of time.

Installation and delivery dates. Included must be a schedule for installation and delivery.

Liquidated damages. Penalties the seller agrees to pay in the event of delays in delivery or other defaults must be stated.

Acceptance. Certain testing and performance standards must be met before any goods or services are accepted.

Guarantee. The responsibility assumed by the seller for repair or replacement of any goods or services which are defective must be set forth.

Terms of use. The use of equipment and other system features to which a firm is entitled for the stated system cost and the rates at which any additional usage will be charged should be specified.

Maintenance. The type, timing, and cost of maintenance services to be provided by the seller must be prearranged, including the seller's policy regarding charges for replacement parts and for retrofitting of parts in accordance with engineering changes, any credits to be allowed in the event of excessive downtime, and storage space or other facilities the firm is required to make available for the seller's maintenance equipment and personnel.

Training services. Any training which the seller is to provide to the firm's personnel should be specified.

Technical service. Services may be provided by the seller's technical personnel to assist a firm in the implementation of the seller's goods or services.

Site preparation. Specifications should be provided for the physical facilities the seller requires a firm to provide as a suitable site for installation of its equipment.

Transportation, installation, relocation, and return of equipment. Responsibilities of a firm and the seller for the arrangements, supervision, labor and expenses related to transportation, installation, relocation, or return of equipment should be prearranged.

Risk of loss or damage. A hold-harmless clause may be negotiated, relieving the firm of risks of loss or damage to equipment during periods of transportation, installation, and (in the case of rented equipment) during the entire time the equipment is in the possession of the firm, except when loss or damage is due to the fault or negligence of the firm.

Tax consideration. Agreement may be made as to the respective responsibilities of a firm and the seller for payment of state and local taxes which may be applicable and as to the pass-through of investment tax credit, if applicable.

Ownership. The extent to which a firm is to acquire title to equipment, software, and other items provided by the seller and the rights of the firm with respect to transfer or assignment of such rights should be stipulated.

Patent and copyright infringement. An agreement may be required by which the seller defends at its expense any action brought against a firm to the extent that it is based on a claim that equipment, software, or other materials used within the scope of the contract infringe a copyright or patent, and agreement that the seller will pay any costs and damages finally awarded against the firm in such an action.

Special items relating to data processing services. If a data processing service is to be utilized by a firm, the contract should contain provisions regarding security which the service is to maintain, measures the service is to take to assure information privacy, audit examination rights, and ownership of files and data processing media containing information related to a firm's data processing applications.

Guidelines for Cost Specifications

The data processing system selected by a firm should be obtainable at a cost which is justifiable in terms of the needs of the firm and the benefits provided. Cost analysis and capital investment evaluation are routine activities for CPAs, and there should be little need to urge that these techniques be used in determining that the cost of a data processing system is justifiable. There are a number of approaches which would be satisfactory for such analysis—the only general requirement being that all costs and benefits are considered in some formula which derives the probable return on investment to be produced by the system.

In estimating the costs of a data processing system for return on investment analysis, a firm should be aware that experience in industry has shown that the cost of data processing equipment accounts for only about 40 percent of an organization's total data processing expenditures. The remainder consists largely of expenditures for the following:

Auxiliary equipment, such as data entry devices (for example, keypunches), terminals, and forms-handling devices (for example, bursters).

Software, such as application programs, utility software, and language compilers which are essential for operating the system and must be leased from the computer vendor or data processing service organization.

File media, such as magnetic tapes, magnetic disks, magnetic tape cassettes, and magnetic diskettes.

Supplies, such as forms, printer ribbons, and punch cards.

Personnel salaries and benefits for personnel assigned to tasks related to the system.

Facilities overhead, such as space and utilities.

Training, including tuition, travel expenses, and so forth, involved in obtaining specialized training necessary for a firm's personnel to effectively operate the system.

Outside personnel services, such as contract programming and temporary help.

Security, such as special vaults or other protection for magnetic tape or disks which are more sensitive to heat and moisture than hard-copy records.

Insurance, including special coverages for expenses to reconstruct data stored on data processing media if it is destroyed and extra cost of operation if a backup data processing facility must be used because of damage or destruction of the primary facility.

Communications facilities, such as the leased telephone lines and modems which may be necessary if the system involves data transmission.

Taxes, such as local property taxes on purchased equipment.

Costs of a system encompass more than the cost of the equipment or service around which the system functions; some costs may begin several weeks or months before the system is ready to commence operation. Some of these costs are "get-ready costs," including such items as expenditures for preparing the site where equipment will be installed and early acquisition of personnel whose time will be committed to being ready for the system when it is ready for operation. Other costs which occur before the system is operating are "conversion costs," including such items as expenditures for creating the

files the system will use and the extra operating cost of the new system running in parallel with the old until its accuracy is proven. (For purposes of your analysis, a firm will probably want to estimate the total of "get-ready" and "conversion" costs and amortize it over the system life—five years is a reasonable period—to arrive at an equitable yearly cost.)

It is possible that the adoption of an automated data processing system will result in some direct cost "savings." A firm should determine this by comparing the recurring costs of the firm's existing methods with the estimated cost of the new system. It must be careful in estimating savings, especially if the savings are derived from the elimination of parts of jobs—unless the payroll is actually reduced or new hirings are actually avoided, no saving will result.

Whatever techniques are used in evaluating the costs and benefits of a system, a firm will need to identify and compile quite a lot of cost data. Appendix 2, page 22, contains examples of forms that can be used in dealing with the costs of a firm's existing system and the suggested replacement system over a five-year period. Each of the forms accommodates summary amounts of cost categories discussed and should be backed up by detailed workpapers. The following forms are illustrated in Appendix 2.

Form 1—Documentation of Existing System Costs. Intended to compile the identifiable recurring costs of the existing system by application.

Form 2—Proposed Equipment Selection and Cost. Intended to detail all expected equipment and related maintenance costs.

Form 3—Proposed System Recurring Costs. Intended to bring together equipment cost summarized from Form 2 and all related operational costs.

Form 4—Documentation of Proposed System Installation Costs. Intended to summarize the expected get-ready and conversion costs.

Form 5—Evaluation of Proposed System Savings. Intended to disclose any cost savings by year from the proposed system change—in the top portion conversion costs are amortized ratably over the expected system life; in the bottom portion costs are recognized as they occur; and residual savings and cumulative net total savings should be identical at the end of the evaluation period.

APPENDIX 1

General System Specifications Checklist

This appendix contains an outline of the guidelines for general system specifications in the form of a checklist which your firm could use in evaluating data processing systems. The checklist is arranged so that reference can easily be made to appropriate sections of the report for background information. Hence, no detailed explanations accompany the questions.

1. Documentation — YES NO

1-1. Does the documentation of the system include User Procedure Documentation (presenting information to help nontechnical personnel to understand the system and providing detailed procedural instructions for tasks related to the system) in the form of a manual which includes

(a) application overview? ___ ___
(b) input preparation procedures? ___ ___
(c) input control procedures? ___ ___
(d) input transmittal procedures? ___ ___
(e) output document descriptions? ___ ___
(f) output control procedures? ___ ___
(g) error correction procedures? ___ ___

1-2. If considering the acquisition of an application software package or a combination package of equipment and software, does the documentation available include Application Technical Documentation which contains

(a) application overview? ___ ___
(b) system flowchart? ___ ___
(c) system flow narrative? ___ ___
(d) file description? ___ ___
(e) input description? ___ ___
(f) output description? ___ ___
(g) processing description? ___ ___

1-3. If the system involves any equipment to be operated by the firm's personnel, does the documentation include Equipment Operations Documentation which contains

(a) equipment set-up instructions? ___ ___
(b) instructions for running the equipment under normal running conditions? ___ ___
(c) any special actions required if trouble develops? ___ ___

2. Processing Throughput

2-1. If the system will be provided by a service bureau, remote batch service, or timesharing service, does the service vendor's commitment as to the time which will elapse between the sending of input and the receipt of finished output adequately satisfy the data processing schedule requirements? ___ ___

2-2. If the system will be provided by an in-house computer, does calculation of processing time, based on your expected volumes and the vendor's throughput rates, adequately satisfy the data processing schedule requirements? ___ ___

3. Data Storage

3-1. Are stated data storage capacities for the system (based on application units) available? ___ ___

3-2. Is the data storage capacity of a computer, or the data storage available from a data processing service at the proposed level of cost, adequate for the firm's expected volume? ___ ___

4. Workload Expansion Capability

4-1. Is the system sufficiently flexible, in terms of equipment or software changes which can be easily made, to respond to reasonably foreseeable changes in processing volumes, schedule requirements, input types and formats, output types and formats, or processing functions? ___ ___

4-2. Are the characteristics of the equipment and software in the system sufficiently similar to higher-level equipment or software available from the computer vendor or data processing service that an upgrade could be readily made? ___ ___

	YES	NO
4-3. If the system involves the installation of a computer, a terminal device, or other equipment, will it be possible to increase the system's workload capacity by exchanging or adding peripheral equipment which provides faster throughput or increased storage capacity?	___	___
4-4. If the programs in the system impose any limits on the volume of application units processed, is it possible to modify these programs to increase the limits?	___	___
5. Programming Language and Operating Software		
5-1. If the system under consideration is either a computer installation or a data processing service which may involve computer programming by the firm's personnel, is the programming language used by the system a widely used programming language?	___	___
5-2. If the system under consideration involves the installation of a larger computer or the use of a timesharing or remote batch service, does the operating software used in the system constrain the ability to modify application programs or unduly restrict the way in which application programs are used?	___	___
6. Data Controls		
6-1. Does the system provide internal hardware and/or software functions to detect		
(a) input errors caused by improper input preparation?	___	___
(b) improper conversion of data to machine-readable form?	___	___
(c) loss of input records?	___	___
(d) input reading malfunctions?	___	___
(e) data transmission malfunctions?	___	___
(f) processing errors caused by hardware malfunction, operator error, or incorrect input data?	___	___
6-2. Does the system incorporate features to facilitate the tracing of processing steps in order to permit the analysis of detail underlying final output, including		
(a) clear designation on each output report as to the individual or business entity to which it relates?	___	___
(b) clear identification of the data fields on each output report by either computer-printed or pre-printed column headings?	___	___
(c) date of all output reports?	___	___
(d) clear designation of all amount fields with a negative value?	___	___
(e) accounting for every transaction entering the system?	___	___
(f) availability for examination, in either hardcopy or visual display form, of every transaction which has affected system records (in accordance with applicable retention period rules)?	___	___
7. Security		
7-1. When considering the use of a data processing service organization, does the firm consider the physical security measures taken by the service organization adequate for		
(a) protection against unauthorized entry?	___	___
(b) protection against fire?	___	___
(c) protection against water damage?	___	___
(d) protection against damage from external events (storms, riots, and so forth)?	___	___
(e) protection against electrical power supply loss?	___	___
(f) provision for use of a backup computer installation far enough away from the primary facility that it would not be subject to the same unanticipated or unpreventable hazards?	___	___
7-2. Will the operation of the system involve adequate protection of data from improper disclosure or modification and from damage or loss?	___	___
8. System Uptime		
8-1. Is information available from the vendor of the system adequate to permit an estimate of how much of the total possible system availability will be lost to "downtime"?	___	___
8-2. Is the estimated system "uptime" (after deducting estimated downtime from total available time) adequate to permit operation in accordance with the firm's data processing schedule?	___	___

	YES	NO
9. Vendor Support		
9-1. Can the vendor demonstrate that its financial condition is sufficient to assure its continued ability to support the system?	___	___
9-2. Will the vendor make available any specialized training needed for personnel to effectively operate the system?	___	___
9-3. Will the vendor make available any technical assistance needed by the firm in converting to the system?	___	___
9-4. Will the vendor make available any assistance the firm may need in connection with technical updating of the equipment and/or software used in the system?	___	___
10. Physical Facility Requirements		
10-1. Can the firm readily and economically provide the following items which may be necessary if the system involves the installation of any equipment on the firm's premises:		
(a) sufficient floor space (with adequate loadbearing capacity) to permit installation of the equipment in a layout which will allow efficient operation and maintenance; additional space required for personnel; and storage of repair parts, supplies, and file media?	___	___
(b) raised flooring?	___	___
(c) electrical facilities?	___	___
(d) temperature and humidity control facilities?	___	___
10-2. Will it be necessary to make special provisions to avoid the disturbance of work areas by noise produced by any equipment installed on the firm's premises?	___	___
10-3. Will it be necessary to provide special telephone lines and/or equipment for any data transmission operations in conjunction with the system?	___	___
11. Personnel Requirements		
11-1. Can the qualifications required for personnel to operate the system be specifically stated in terms of data processing education, experience, and aptitudes?	___	___
11-2. Are personnel having the required qualifications available within the firm, or could they be readily employed?	___	___
11-3. Could the reassignment of personnel within the firm and/or the addition of personnel to the firm's staff, as necessary to operate the system, be accomplished without unfavorable organizational or economic impact?	___	___
12. Business Relationship With the Seller of the System		
12-1. Will the firm's business relationship with the seller of the system include a formal contractual agreement?	___	___
12-2. Will the contract contain provisions regarding the following items and any other provisions considered necessary by the firm's legal counsel:		
(a) specifications and costs?	___	___
(b) term of agreement?	___	___
(c) commitments, warranties, and representations?	___	___
(d) installation and delivery dates?	___	___
(e) liquidated damages?	___	___
(f) acceptance?	___	___
(g) guarantee?	___	___
(h) terms of use?	___	___
(i) maintenance?	___	___
(j) training services?	___	___
(k) technical services?	___	___
(l) site preparation?	___	___
(m) transportation, installation, relocation, and return of equipment?	___	___
(n) risk of loss or damage?	___	___
(o) tax considerations?	___	___
(p) ownership?	___	___
(q) patent and copyright infringement?	___	___
12-3. If a data processing service is to be utilized, will the contract also contain provisions regarding the following items:	___	___
(a) security which the service is to maintain?	___	___
(b) measures the service is to take to assure information privacy?	___	___

	YES	NO
(c) audit examination rights?	___	___
(d) ownership of files and data processing media containing information related to the firm's data processing applications?	___	___

13. Cost Justification

13-1. Have you performed a cost analysis for the proposed new system which included identifying and compiling the following (see forms in Appendix 2):

	YES	NO
(a) existing system costs?	___	___
(b) proposed equipment cost?	___	___
(c) proposed system recurring costs?	___	___
(d) proposed system installation costs?	___	___
(e) proposed system savings?	___	___

13-2. Based on the results of the above cost analysis and the benefits the firm expects to derive from the proposed system, is the system obtainable at a justifiable cost? ___ ___

APPENDIX 2

Cost Analysis Forms

This appendix contains examples of five forms which could be used in dealing with the costs of a firm's existing system and a suggested replacement system over a five-year period. For background information on the use of these forms refer to the Cost Specifications section which begins on page 16.

Form 1
DOCUMENTATION OF EXISTING SYSTEM COSTS

APPLICATION	COST ELEMENTS	YEAR					5-YEAR TOTAL
	Salaries						
	Machine Rentals or Amortization						
	Space						
	Utilities						
	Supplies						
	COST TOTALS						
	Salaries						
	Machine Rentals or Amortization						
	Space						
	Utilities						
	Supplies						
	COST TOTALS						
	Salaries						
	Machine Rentals or Amortization						
	Space						
	Utilities						
	Supplies						
	COST TOTALS						

Explanatory Notes or Comments:

Form 2

PROPOSED SYSTEM EQUIPMENT SELECTION AND COST

EQUIPMENT NAME & MODEL NUMBER	EQUIPMENT SPECIFICATIONS	YEARLY COSTS					5-YEAR TOTAL

Form 3
PROPOSED SYSTEM RECURRING COSTS

COST ELEMENTS		YEARLY COSTS					5-YEAR TOTAL
PERSONNEL COSTS	Supervision						
	Systems and Programming						
	Equipment Operators						
	All Other						
	TOTAL PERSONNEL COSTS						
MACHINE AND EQUIPMENT OR SERVICES COSTS	Computer/Services						
	Peripheral and All Other						
	TOTAL EQUIPMENT/SERVICES COSTS						
SPACE							
UTILITIES							
SUPPLIES							

Form 4

DOCUMENTATION OF PROPOSED SYSTEM INSTALLATION COSTS

COST ELEMENTS		YEARLY COSTS					5-YEAR TOTAL
TRAINING AND EDUCATION OF PERSONNEL	Systems Analysts						
	Programmers						
	All Other						
	TOTAL TRAINING COSTS						
SYSTEMS DESIGN AND PROGRAMMING	Systems Design						
	Programming						
	All Other						
	TOTAL SYSTEMS AND PROGRAMMING						
SITE PREPARATION	Planning Time or Consultant Costs						
	Partitions, Flooring, Ceilings, Etc.						
	Utilities and Air Conditioning						
	Moving Costs						
	All Other						
	TOTAL SITE PREPARATION						
PROGRAM TESTING AND PARALLEL OPERATIONS	Debugging						
	Parallel Operations						
	All Other						
	TOTAL TESTING AND PARALLEL OPERATIONS						
MISCELLANEOUS	Data File Conversion						
	All Other						
	TOTAL MISCELLANEOUS						

Form 5
EVALUATION OF PROPOSED SYSTEM SAVINGS

ITEM DESCRIPTION	YEARLY AMOUNTS					5-YEAR TOTAL
Present System Recurring Costs						
Less: Proposed System Recurring Costs						
Savings Before Conversion Costs						
Less: Amortized Conversion Costs						
Residual Savings						
PROPOSED ACTION COST/SAVINGS SCHEDULE						
Existing System Expenditures						
Proposed System Expenditures						
Conversion Expenditures						
TOTAL COSTS EXPENDED						
Present System Recurring Costs						
Net Total Savings						
Cumulative Net Total Savings						
MEMORANDUM (NEW WORK) VALUES						

APPENDIX 3

Data Processing Equipment and Services Used by CPA Firms

The four tables found in this appendix were taken from the 1974 AICPA EDP Survey that was sent to more than 17,000 CPA firms. The survey included questions regarding CPA firms' current and planned use of in-house computer systems, timesharing, and service bureaus. Approximately 3,500 CPA firms responded to the survey.

The purpose of including this information in *General System Specifications* is to give the prospective user of data processing some idea of what other CPAs are doing. Any CPA contemplating using either a service bureau, timesharing, or in-house computer system is invited to write to the computer services division of the AICPA for the names of fellow practitioners to contact for information about their experience with specific vendors, computers, and/or processing options. One of the best ways to avoid making the same mistake is to talk to another CPA who has gone through the sometimes "trying" period of the beginner in data processing.

It is often unwise to draw conclusions from a limited survey; they can be more harmful than helpful. However, the following are some generalizations that can be drawn from the accompanying tables.

- Burroughs, IBM, Litton, and NCR account for more than 75 percent of the in-house equipment installed. The L-8000 Series of Burroughs accounted for about 75 percent of the 193 Burroughs installations. Sixty percent of IBM's installations were System 3's, while more than 50 percent of NCR's machinery was the 200-300 computer series.
- Client accounting was the most popular service offered by the CPA firms. Within client accounting, the general ledger appeared to be the biggest attraction. It is interesting to note that only 40 percent of the firms offering a general ledger also prepare financial statements using the computer. This could be caused by the lack of flexibility in formatting the statements to suit the CPA's clients' requirements.
- Some applications appear to be better suited to timesharing than to service bureau or in-house processing. Return preparation seems to be better suited to timesharing and service bureau processing than in-house, while tax planning is exclusively a timesharing application.
- Client accounting is equally divided between in-house and service bureau processing, whereas audit assistance is primarily a timesharing application (statistical sampling, random number generation, and so forth).
- Surprisingly, timesharing is favored for CPA firm practice administration (time and billing) over in-house. This may be accounted for by the complexity of a time and billing system and that some timesharing companies have good programs that they lease for a fraction of what they cost to develop.

The 1974 survey is now almost two years old, a very long time in such a dynamic industry. However, if a survey were conducted today it is suspected that only the numbers would change; the percentages would remain about the same.

TABLE I
Data Processing Equipment Used by CPA Firms—In-House

	Basic Four	Burroughs	Data Point	Eldorado	Fedders	Friden	Honeywell	IBM	Litton	NCR	Olivetti	Singer	UNIVAC	Other	Total
	4	193	6	7	4	8	6	232	179	79	8	12	12	23	773
Alabama		7						6	1	3	1			2	20
Alaska		1													1
Arizona		3							4	1	1	1			10
Arkansas		6						2		1					9
California	4	27	2	2		1		14	11	5	1		1	8	76
Colorado		3		1				1	8	3				1	17
Connecticut		3				1		3	7	1	1				16
Delaware		2				1									3
Florida		7	1					5	10			1		1	25
Georgia		5					1	6	4	3					19
Hawaii		3			1					1					5
Idaho		5						2		2					9
Illinois		3					1	9	6	4		1		2	26
Indiana		7						9	6	2					24
Iowa		3								2		1	1		7
Kansas		6						8	1	3			1		19
Kentucky		1							1	3		1			6
Louisiana		7				1		6	2	2					18
Maine								2		2					4
Maryland		1	1			1		4	3	1					11
Massachusetts		1						3	5	1			1	1	12
Michigan		2		1				10	13	3				1	30
Minnesota		1						7	5	1					14
Mississippi		3						2				1			6
Missouri		4	1			1		13	1	2					22
Montana		2						3		1					6
Nebraska		2						5		2					9
Nevada		2						2							4
New Hampshire									1						1
New Jersey		1		1				3	10			1	2		18
New Mexico		2						2		3					7
New York		3			1		1	15	8		1	1	1		31
North Carolina		5						5	4	4					18
North Dakota								1							1
Ohio		8					1	9	15	4		1		1	39
Oklahoma		3						6	7	2	1		2		21
Oregon		3						2	5	2					12
Pennsylvania		4					1	12	3		1	2	2	2	27
Rhode Island								2							2
South Carolina		2						1	2						5
South Dakota								3							3
Tennessee		3			1			3	3	2					12
Virginia		7						3	6	1	1		1		19
Washington								2	4					1	7
Washington, D.C.		1				1		1	1						4
West Virginia		4						4	3	1					12
Wisconsin		6					1	7	1	2		1			18
Texas		17		2	1	1		26	17	8				3	75
Utah		1	1					3	1	1					7
Wyoming		6													6

OTHER:

Cascade (1)	MAI (2)	Wang (3)
Control Data (1)	Nixdorf (2)	Monroe (2)
Data Cap Int'l (2)	PDS (3)	Howlit-Packard (1)
Dec (2)	Stritec (1)	Not Identified (3)

Source: 1974 AICPA EDP Survey

TABLE II

Data Processing by Services Used by CPA Firms—
In-House Systems

APPLICATIONS	Basic Four	Burroughs	Data Point	Eldorado	Fedders	Friden	Honeywell	IBM	Litton	NCR	Olivetti	Singer	UNIVAC	Other	Total
TOTALS	4	193	6	7	4	8	6	232	179	79	8	12	12	23	773
INCOME TAX APPLICATIONS	1	26		2			22	18	2				1	2	74
Return Preparation															
Tax Planning															
CLIENT ACCOUNTING															
Report Preparation						1									
Financial Statements		39	1			1		41	97	13		1	6	7	206
Depreciation		12						15	19				1	3	50
Budgets/Projections		1													1
Other		17					1		5	4	1	1		1	30
RECORD KEEPING	4	137	4	7	1	2	4	163	132	59	4	2	11	14	544
General Ledger		15	2	1				84	26	19		3	2	8	160
Accounts Receivable		8	1					27	1	2				3	42
Accounts Payable	3	82	2	5	1	2	1	103	73	32	3	3	4	10	324
Payroll		10			1		1	24	7	10			1		54
Billing	4	3	1					14	2	2			2	1	29
Inventory															
AUDIT ASSISTANCE								7					1		8
CPA FIRM PRACTICE															
Time & Billing	3	19	1	1			3	52	31	9		1	1	6	127

Source: 1974 AICPA EDP Survey

TABLE III

Data Processing Services Used by CPA Firms—by Type of Processing

APPLICATIONS	IN-HOUSE No.	IN-HOUSE %	TIME-SHARING No.	TIME-SHARING %	SERVICE BUREAU No.	SERVICE BUREAU %
TOTALS	773	100.0	182	100.0	1624	100.0
Tax Preparation						
Return Preparation	74	9.6	36	19.8	294	18.1
Tax Planning			20	11.0		
CLIENT ACCOUNTING						
Report Preparation						
Financial Statements	206	26.8	35	19.2	408	25.1
Depreciation	50	6.5	15	8.2	24	1.5
Budgets/Projections	1	—	41	22.5	9	—
Other	30	3.9	19	10.4	48	2.9
Record Keeping						
General Ledger	544	70.6	81	44.5	1091	67.2
Accounts Receivable	160	20.8	15	8.2	130	8.0
Accounts Payable	42	5.5	1	—	31	1.9
Payroll	324	42.1	25	13.7	315	19.4
Billing	54	7.0	3	—	37	2.3
Inventory	29	3.8	2	—	21	1.3
AUDIT ASSISTANCE	8	1.0	40	22.0	12	—
CPA FIRM PRACTICE						
Time & Billing	127	16.5	38	20.1	168	10.3

Source: 1974 AICPA EPD Survey

TABLE IV

Data Processing Services Used by CPA Firms—by Timesharing Vendor

APPLICATIONS	COMPU-SERV	COMPU-TIME	DIAL-COM	GE	INT'L TIMESHARE	LEASCO	MULTI-TAX	SERVICE BUREAU	OTHER
TOTALS	4	8	5	68	6	10	3	9	69
INCOME TAX APPLICATIONS									
Return Preparation				19	3	1	3		10
Tax Planning				9				1	10
CLIENT ACCOUNTING									
Report Preparation									
Financial Statements	1	1	3	11	1	2			16
Depreciation	1		1	6	1	1			5
Budgets/Projections	2			16	4	2		4	13
Other	1	2		8	1	2		1	4
Record Keeping									
General Ledger	2	6	5	19	1	7		2	49
Accounts Receivable						3			12
Accounts Payable									1
Payroll		1		2	1	3			19
Billings									3
Inventory									2
AUDIT ASSISTANCE	2	1	1	19	1	3		1	12
CPA FIRM PRACTICE									
Time & Billing		1	1	14	1	2		1	18

Other: Includes less than two users responded per supplier or supplier not specified.
Source: 1974 AICPA EDP Survey

APPENDIX 4

Reference List of Books, Articles, and Periodicals

The purpose of this appendix is to give the prospective user of data processing a bibliography of nontechnical books, pamphlets, and articles that will help in the transition from the manual world of accounting to the sometimes hectic and complex world of data processing.

The references included here represent only a small portion of the thousands of books and articles written each year. The criteria for selection was primarily ease of reading and understanding by an accountant not experienced in data processing.

All of the books, articles, and magazines are in the AICPA library, and any AICPA member can borrow them for a short period of time at no charge.

ARTICLES

A Sole Practitioner Takes a Hard Look at an Accounting Computer, William L. Stenger, *Journal of Accountancy,* January 1975, pp. 41-43.

Accounting Use of Computer Time-Sharing Services, The, Melvin Bund, *The CPA Journal,* September 1973, pp. 799-801.

Approaches to Electronic Data Processing, *Datapro Research Corporation,* October 1974.

Case Study, Edward J. Case, *Chartered Accountant,* August 1973, pp. 31-33.

Computer as an Auditing Tool, The, Reed O. Leishman, *Internal Auditor,* January-February 1971, pp. 22-27.

Computer Service Centers, *Datapro Research Corporation,* October 1974.

Considerations of Physical Security in a Computer Environment, *IBM publication* (Document No. G520-2700).

Customizing the Computer to Solve Special Client Problems, Irwin Wagner, *The Practical Accountant,* March-April 1973, pp. 60-61.

Do Your Write-Ups on Your Own Mini-Computer, John L. Willis, *The Practical Accountant,* November-December 1973, pp. 33-38.

Duality in the Accounting Profession, Max Block, *The CPA,* July 1974, pp. 29-33.

Get the Computer System You Want, Roy N. Freed, *Harvard Business Review,* November-December 1969, pp. 97-108.

Guide to Negotiating a Computer Contract, R. P. Bigelow, *Computerworld,* 1969.

How Accountants Can Evaluate the Needs of Computers or Computer Services, Bryan Mills, *International Accountant,* July-September 1974, pp. 69-71.

How to Buy Software Packages, *Datapro Research Corporation,* 1972.

How to Plan and Implement a New Computer Installation, *Datapro Research Corporation,* 1972.

In-house Computing Power for the Small Business, William B. Martin, *Modern Office Procedures,* June 1974.

Meeting the Needs of Clients With Computer Systems, Fred L. Lilly, *Journal of Accountancy,* December 1974, pp. 109-111.

New Approaches of Offering Clients EDP Services, Michael L. Cerullo, *Massachusetts CPA Review,* July-August 1974, pp. 12-16 and 26.

Notes for Accountants on Computer Time-Sharing Services, Melvin Bund, *The CPA Journal,* March 1973, pp. 241-244.

Remote Computing Services, *Datapro Research Corporation,* October 1974.

Small Businesses Can Be Computerized, Wayne W. McKee, *Management Accounting,* April 1972.

Small Business Data Processing (Where Will New Mechanized Users Go?), David G. Jung, *Modern Office Procedures,* February 1974.

42 Suggestions for Improving Security in Data Processing Operations, *IBM publication* (Document No G-520-2797).

To EDP or Not, H. P. Hanna, *Accountants' Journal,* October 1973, pp. 111-113.

Untapped Computer Service Bureau Potential, Michael L. Cerullo, *Journal of Accountancy,* December 1974, pp. 106-109.

Use of Timesharing in the CPA Firm, The, Frederick S. Schiff, *Journal of Accountancy,* January 1974.

Using the Computer as an Audit Tool, William R. Welke and Karl G. King III, *The CPA Journal,* November 1972, pp. 930-932.

Using the Computer in Audit Work, Clarence O. Smith and Geraldine F. Jasper, *Management Accounting,* October 1972, pp. 34-42.

BOOKS

American Institute of Certified Public Accountants. *Approach to the Use of EDP in an Accounting Practice.* Computer Research Study No. 6, New York: American Institute of Certified Public Accountants, 1968.

———. *Audits of Service-Center-Produced Records.* Industry Audit Guide, New York: American Institute of Certified Public Accountants, 1974.

———. *Effects of EDP on the Auditor's Study and Evaluation of Internal Control.* SAS No. 3, New York: American Institute of Certified Public Accountants, 1974.

Awad, Elias M. *Business Data Processing.* Englewood Cliffs, N.J. Prentice-Hall, Inc., 1974.

Clifton, Harold D., and Lucey, Terrance, *Accounting and the Computer System.* New York: Petrocelli Books Inc., 1974.

Davis, Gordan B. *Auditing and EDP.* New York: American Institute of Certified Public Accountants, 1968.

———. *Computer Data Processing.* 2d ed. New York: McGraw Hill Book Co., 1973.

Maurer, W. D. *Programming: An Introduction to Computer Languages and Techniques.* San Francisco: Holden-Day Book Co., 1968.

Woolridge, Susan, and London, Keith. *The Computer Survival Handbook.* New York: McGraw Hill Book Co., 1973.

MONTHLY PERIODICALS

Computerworld. Computerworld Circulation Department, 797 Washington Street, Newtonville, Mass. 02160. This is a weekly newspaper that keeps the reader up to date. It is not an overly technical publication. $12 per year.

Computers and Automation. Circulation Department, Berkeley Enterprises Inc., 815 Washington Street, Newtonville, Mass. 02160.
This is a monthly magazine that contains both technical and nontechnical material. $11.50 per year.

Datamation. Circulation Department, 35 Mason Street, Greenwich, Conn: 06830.
A monthly magazine that is usually technical, but there are many articles in each issue that the beginner in EDP can understand. Cost: Free to certain persons (contact the magazine to see if you qualify); otherwise, $24 per year.

EDP Analyzer. Subscription Office, 925 Anza Avenue, Vista, California 92083.
This is a monthly publication that is not usually technical; each issue researches a specific data processing topic. $48 per year.

EDPACS. Subscription Manager, Automation Training Center, Inc., 11250 Roger Bacon Drive, Suite 17, Reston, Va. 22090.
This is a monthly publication that is not technical. $48 per year.

APPENDIX 5

Explanation of Data Processing Terms Used in This Report

Algorithm. A sequence of formulas and/or algebraic/logical steps to calculate or determine a given task.

Compatibility. The quality of an instruction to be translatable or executable on more than one class of computer; generally the ability to utilize data processing facilities of different manufacturers.

Data Storage Facility. A device that stores machine readable data.

Disk. A data storage facility consisting of circular metal plate(s) with magnetic material on its surfaces which continuously rotate; used for random and sequential access.

Downtime. The time during which a computer is unavailable for productive use because of preventive maintenance or equipment malfunctions.

Field. A specialized area of a record used for a particular category of data (e.g. social security number in a payroll master record).

File. Any collection of informational items similar to one another in purpose, form, and content (e.g. all employees' information records in a payroll master file).

Flowchart. A graphical representation of procedures, flow of data, growth, equipment, methods, documents, and machine instructions.

Halt. A machine stoppage that might be deliberately programmed, may result from a logical error in programming, or from a mechanical failure.

Hardware. The physical equipment or devices forming a computer configuration.

Input. Information to be transferred into the internal storage of the computer.

Interface. A common boundary between automatic data processing systems or parts of a single system.

Key. A unique group of characters which distinguishes records; thus any entry in a record or item which can be used as a key for collating or sorting purposes.

Magnetic tape. A data storage facility consisting of tape coated wtih magnetic or other material on which information may be placed in the form of magnetically polarized spots.

Memory. An organization of storage units within the computer.

MTBF. Mean time between failures.

MTTR. Mean time to repair.

Multi-programming. Permitting more than one program to operate simultaneously within the same computer.

Output. Information transferred from the internal storage of the computer.

Password. A unique combination of characters known only by a specific user which identifies him to the computer in order for the user to gain access to the computer's functions.

Peripherals. The input-output units connected to a computer (card readers, card punches, etc.).

Printer control loop. A strip of paper or mylar used to control vertical spacing of a printer.

Priority. The basis of selecting the sequence in which various entries and tasks are processed by the computer.

Program. A plan for the computer solution of a problem; a set of instructions or steps that tells the computer exactly how to handle a complete problem.

Real time. The performance of a computer process in sufficient time to guide the process; connotes on-line, multi-programming environments.

Record. A group of related fields of information treated as a unit (e.g. an individual employee's information in a payroll master file).

Restart. To return to a specific previous point in a program and resume operation from that point; usually used if an error is detected between two points.

Scrambling. The use of codes to convert inputted characters to non-usable form for purposes of securing the data.

Software. The collection of programs associated with a computer.

Tables. A collection of data in a form suitable for ready reference, each item being uniquely identified.

Terminal. A device in a system or communication network by which data can be inputted and/or outputted.

Timesharing. A computer technique in which numerous users can assess a central computer concurrently for input, processing, and output.

Uptime. The time during which equipment is fully operational and available for processing.

Validation tests. The closeness by which the repeated results approach the correct result.